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Applicant(s) : Shao-Hua Guo et al.
Application Number : 09/934,878
Filed : August 22, 2001
Title : PREPARATION OF ACRYLIC POLYOLS
Group Art Unit : 1621
Examiner : Elvis O. Price
Docket No. : 01-2580A

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. § 1.192(d)

I. REAL PARTY IN INTEREST

The real party in interest is Arco Chemical Technology, L.P.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Applicants, their representatives, or their assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1, 3-11, and 14-18 are on appeal.

IV. GROUPING OF CLAIMS

The claims on appeal shall stand or fall together.

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V. STATUS OF AMENDMENTS

Claims on appeal have been amended after the Final Office Action for minor corrections. The amendments have been entered by the Examiner in the Advisory Action.

VI. SUMMARY OF THE INVENTION

The invention is a process for making acrylic polyols by free radically copolymerizing an alkoxylated allyl alcohol with alkyl acrylate or methacrylate. The process is performed in essentially the absence of styrene, methyl acrylate, methyl methacrylate, and allyl alcohol.

Contrary to the common belief in the art that polymerization of allyl monomers cannot reach a high monomer conversion due to their *degradative chain transfer*, Applicants' process gives a monomer conversion of 90% or greater as a result of using essentially no styrene, no methyl acrylate, and no methyl methacrylate, and using alkoxylated allyl alcohol rather than allyl alcohol.

VII. QUESTION PRESENTED FOR REVIEW

Whether Applicants' invention is obvious over U.S. Pat. No. 5,475,073 (*Guo*) in view of U.S. Pat. No. 6,127,500 (*Guo et al.*), and further in view of the *Aldrich* catalog, while the combination of the references fails to teach or suggest all claim limitations, fails to provide any suggestion or motivation to modify the references to make the invention, and fails to provide any reasonable expectation of success of the invention.

VIII. ARGUMENTS

Applicants contend that there is no *prima facie* case of obviousness for the present claims over *Guo* in view of *Guo et al.* and further in view of the *Aldrich* catalog. MPEP §2142 provides

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.”

Applicants respectfully ask the Honorable Board to review and reverse the Examiner's obviousness rejection because none of these three requirements provided by MPEP §2142 is satisfied by the rejection.

(I) All Claim Limitations Must Be Taught or Suggested

To establish a *prima facie* case of obviousness, the Examiner must consider all claim limitations. MPEP §2143.03 provides that “To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.” *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). The Examiner's rejection must be reversed because the combined references do not teach or suggest all the limitations of the claims.

Two essential limitations of Applicants' claims were ignored by the Examiner: (1) the process of the invention is conducted essentially in the absence of styrene, methyl acrylate and methyl methacrylate; and (2) the process excludes the use of allyl alcohol. These two limitations cannot be found from *Guo*, *Guo et al.*, or the *Aldrich* catalog, or any combinations thereof.

Applicants have provided ample evidence in the application which shows that when these conditions are met, the process achieves a high monomer conversion (90 % or greater) and otherwise, the process gives a much lower monomer conversion. For

instance, the polymerization of allyl alcohol monopropoxylate and n-butyl acrylate in the absence of styrene gives an almost complete monomer conversion (Example 1: 99.5% conversion). However, the same polymerization in the presence of styrene gives only 88.8% of monomer conversion (Comparative Example 3).

Unlike the present invention, *Guo* and *Guo et al.* teach the use of styrene, methyl acrylate or methacrylate, and allyl alcohol in the process. As discussed above, the reference process gives a monomer conversion that is considerably lower than that of the present invention. The *Aldrich* catalog is not even relevant here because it provides no helpful information in this regard.

In summary, Applicants respectfully ask the Honorable Board to reverse the obviousness rejection because the combined teachings of the references neither teach nor suggest two essential claim limitations: (1) the process of the invention is conducted essentially in the absence of styrene, methyl acrylate and methyl methacrylate; and (2) the process excludes the use of allyl alcohol, while these two elements are essential to achieve an substantially increased monomer conversion of the process.

(II) Suggestion or Motivation to Modify the References

The Examiner has two essential contentions with regard to the motivation to modify the references. First, the Examiner contends: since *Guo* teaches a process for preparing acrylic polyols which encompasses the process conditions of the present invention (e.g., the reaction temperature, type and amount of monomer used, type of initiator, etc.), a reasonable artisan will be motivated by *Guo* to make the present invention. Second, the Examiner contends: even if *Guo* itself is not enough to motivate a reasonable artisan to make the present invention, *Guo et al.* teaches that the acrylic polyols made in *Guo* are valuable materials, and this teaching will motivate a reasonable artisan to modify the *Guo* process. These contentions are inconsistent with MPEP §2143.01 and therefore they must fall.

MPEP §2143.01 instructs that "A statement that modifications of the prior art to meet the claimed invention would have been " 'well within the ordinary skill of the art at the time the claimed invention was made' " because the references relied upon teach that

all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.”

According to the Examiner, because *Guo* teaches a process for making acrylic polyols, a reasonable artisan will be motivated by *Guo* to conduct the polymerization in the absence of styrene, methyl acrylate (or methacrylate), and allyl alcohol in order to increase the monomer conversion regardless of the fact that *Guo* specifically teaches the use of these monomers. According to the Examiner, because *Guo* teaches that the reaction temperature can be up to 300°C, a reasonable artisan will be motivated to conduct the reaction at a reflux condition. According to the Examiner, because *Guo*’s material is valuable, any improvement of the material would be obvious. Following the Examiner’s reasoning, no inventions after *Guo* in the area of making acrylic polyols from allylic monomers would be possibly patentable.

According to the instruction of MPEP §2143.01, the Examiner must provide some objective reason to modify the teachings of the references. The Examiner has failed to do so. Thus, Applicants respectfully ask the Honorable Board to reverse the rejection.

(III) Reasonable Expectation of Success

Applicants respectfully ask the Honorable Board to review and reverse the Examiner’s obviousness rejection also because the Examiner fails to satisfy the second requirement of MPEP §2142: the combined teachings of the references must provide a reasonable expectation of success.

As Applicants discussed in the Background of the Invention, making acrylic polyols from allylic monomers is difficult because of low monomer conversion. Removing and recycling unreacted monomers is inconvenient and costly. *See the application, page 2, lines 16-19.* The problem of low monomer conversion of allylic polymerization is well recognized in the art and is commonly believed to be resulted from the *degradative chain transfer* of allylic monomers. *See “Principles of Polymerization” by George Odian, pages 250-251 (attached).*

The combined teachings of *Guo*, *Guo et al.* and the *Aldrich* catalog provide no hint that the process of the present invention would have any chance of success to achieve a monomer conversion greater than 90%. In fact, *Guo* teaches the opposite. In *Guo*'s Example 1, allyl alcohol, methyl methacrylate and 2-ethylhexyl acrylate are polymerized; the total monomer conversion is only 67.9%. In *Guo*'s Example 2, allyl alcohol, styrene, n-butyl methacrylate and n-butyl acrylate are polymerized; the total monomer conversion is only 75.8%. In *Guo*'s Example 3, allyl alcohol, t-butyl acrylate and n-butyl acrylate are polymerized; the total monomer conversion is only 70%. In *Guo*'s Example 4, allyl monopropoxylate and methyl methacrylate are polymerized; the total monomer conversion is only 80.7%. In *Guo*'s Example 5, allyl monopropoxylate, 2-ethyl acrylate and methyl methacrylate are polymerized; the total monomer conversion is only 72.4%. These monomer conversions are well below what Applicants claim: 90% or greater.

Therefore, Applicants respectfully ask the Honorable Board to reverse the obviousness rejection under the second requirement of MPEP §2142 because the combined teachings of the references provide no reasonable expectation of success of the present invention.

In conclusion, Applicants' claims are non-obvious. Accordingly, Applicants respectfully ask the Honorable Board to reverse the rejections and to allow claims 1, 3-11, and 14-18.

Respectfully submitted,
Shao-Hua Guo et al.

By: Shao-hua Guo

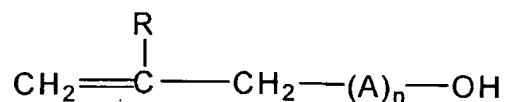
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AppendixClaims on Appeal

1. A process for making an acrylic polyol, said process being performed essentially in the absence of styrene, methyl acrylate and methyl methacrylate, and comprising:

- (a) initially charging a reactor with an allylic alcohol, 0-50% of the total amount to be used of a C₂-C₂₀ alkyl or aryl acrylate or methacrylate monomer and 0-100% of the total amount to be used of a free-radical initiator;
- (b) heating the reactor contents to a temperature within the range of 100-250°C; and
- (c) gradually adding to the reactor the remaining acrylic monomer and initiator;

wherein the allylic alcohol has the general structure:



in which R is hydrogen, a C₁-C₁₀ alkyl, or a C₆-C₁₂ aryl group; A is an oxyalkylene group; and n, which is an average number of oxyalkylene groups, is within the range of 1 to about 5; and wherein the process gives a total monomer conversion greater than about 90%.

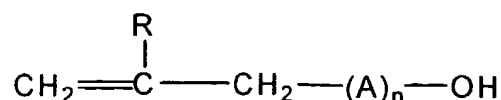
3. The process of claim 1 having a total monomer conversion greater than about 95%.

4. The process of claim 1 having a total monomer conversion greater than about 99%.

5. The process of claim 1 wherein the acrylic polyol has a number average molecular weight less than about 5,000 and a weight average molecular weight less than about 10,000.

6. The process of claim 1 wherein the acrylic polyol has a number average molecular weight less than about 2,500 and a weight average molecular weight less than about 5,000.
7. The process of claim 1 wherein the acrylic polyol has a molecular weight distribution less than about 3.5.
8. The process of claim 1 wherein the acrylic polyol has a molecular weight distribution less than about 2.5.
9. The process of claim 1 wherein the liquid acrylic polyol has a hydroxyl number within the range of about 20 mg KOH/g to about 250 mg KOH/g.
10. The process of claim 1 wherein the acrylic monomer is a C₂-C₂₀ alkyl acrylate or methacrylate.
11. The process of claim 1 wherein the acrylic monomer is selected from the group consisting of 2-ethylhexyl acrylate, n-butyl acrylate, 2-ethylhexyl methacrylate, hexyl methacrylate, n-butyl methacrylate, isobornyl methacrylate, and mixtures thereof.
14. The process of claim 1 wherein n is within the range of about 1 to about 2.
15. The process of claim 1 wherein the allylic alcohol is allyl alcohol monopropoxylate.
16. A process for making an acrylic polyol, said process being performed at reflux temperature under atmospheric pressure, essentially in the absence of styrene, methyl acrylate and methyl methacrylate, and comprising:
 - (a) initially charging a reactor with an allylic alcohol, 0-50% of the total amount to be used of C₂ to C₂₀ alkyl or aryl acrylate or methacrylate and 0-100% of the total amount to be used of a free-radical initiator;
 - (b) heating the reactor contents to reflux; and
 - (c) gradually adding to the reactor the remaining acrylic monomer and initiator;

wherein the acrylic monomer has a boiling point the same as or higher than the allylic alcohol, wherein the allylic alcohol has the general structure:



in which R is hydrogen, a C₁-C₁₀ alkyl, or a C₆-C₁₂ aryl group; A is an oxyalkylene group; and n, which is an average number of oxyalkylene groups, is within the range of 1 to about 15; and wherein the process gives a total monomer conversion greater than about 90%.

17. The process of claim **16** having a total monomer conversion greater than about 95%.

18. The process of claim **17** wherein the free-radical initiator contains less than 30 wt % of water.